

11-24-00

A

JC849 U.S. PTO
11/22/00

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Inventorship Evans
 Applicant Microsoft Corporation
 Attorney's Docket No. MS1-707US
 Title: Improved Restricted Content Viewing Methods and Arrangements For Use in a DVD Player

JC921 U.S. PTO
09/721542
11/22/00TRANSMITTAL LETTER AND CERTIFICATE OF MAILING

To: Commissioner of Patents and Trademarks
 Washington, D.C. 20231

From: Thomas A. Jolly (509) 324-9256
 Lee & Hayes, PLLC
 421 W. Riverside Avenue, Suite 500
 Spokane, WA 99201

The following enumerated items accompany this transmittal letter and are being submitted for the matter identified in the above caption.

1. Transmittal Letter with Certificate of Mailing included.
2. PTO Return Postcard Receipt
3. Check in the Amount of \$750.00
4. Fee Transmittal
5. New patent application (title page plus 42 pages, including claims 1-17 & Abstract)
6. Executed Declaration
7. 7 sheets of formal drawings (Figs. 1-14)
8. Assignment w/Recordation Cover Sheet

Large Entity Status ☒ [x]

Small Entity Status ☐ []

The Commissioner is hereby authorized to charge payment of fees or credit overpayments to Deposit Account No. 12-0769 in connection with any patent application filing fees under 37 CFR 1.16, and any processing fees under 37 CFR 1.17.

Date: 11-22-2000

By:

Thomas A. Jolly
 Reg. No. 39,241

CERTIFICATE OF MAILING

I hereby certify that the items listed above as enclosed are being deposited with the U.S. Postal Service as either first class mail, or Express Mail if the blank for Express Mail No. is completed below, in an envelope addressed to The Commissioner of Patents and Trademarks, Washington, D.C. 20231, on the below-indicated date. Any Express Mail No. has also been marked on the listed items.

Express Mail No. (if applicable)

EL685270515

Date:

11/22/00

By:

Lori A. Vierra

EL685270515

PTO/SB/17 (11-00)

Approved for use through 10/31/2002. OMB 0651-0032
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE

Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number.

**FEE TRANSMITTAL
for FY 2001**

Patent fees are subject to annual revision.

TOTAL AMOUNT OF PAYMENT

(\$) 750.00

Complete if Known

Application Number

Filing Date

First Named Inventor Evans

Examiner Name

Group Art Unit

Attorney Docket No.

MSI-707US

09/12/02
11/22/00**METHOD OF PAYMENT**

- 1.
- ☒
- The Commissioner is hereby authorized to charge indicated fees and credit any overpayments to:

Deposit
Account
Number

12-0769

Deposit
Account
Name

Lee & Hayes, PLLC

- ☒
- Charge Any Additional Fee Required
-
- Under 37 CFR 1.16 and 1.17

- ☐
- Applicant claims small entity status.
-
- See 37 CFR 1.27

- 2.
- ☒
- Payment Enclosed:

- ☒
- Check
- ☐
- Credit card
- ☐
- Money
-
- Order
- ☐
- Other

FEE CALCULATION**1. BASIC FILING FEE**

Large Entity Small Entity

Fee Fee Fee Fee Fee Description

Code (\$) Code (\$) Code (\$)

101 710 201 355 Utility filing fee

106 320 206 160 Design filing fee

107 490 207 245 Plant filing fee

108 710 208 355 Reissue filing fee

114 150 214 75 Provisional filing fee

Fee Paid

710

SUBTOTAL (1) (\$) 710

2. EXTRA CLAIM FEES

Total Claims 17 -20** = X =
 Independent Claims 3 -3** = X =
 Multiple Dependent =

Large Entity Small Entity

Fee Fee Fee Fee Fee Description

Code (\$) Code (\$) Code (\$)

103 18 203 9 Claims in excess of 20

102 80 202 40 Independent claims in excess of 3

104 270 204 135 Multiple dependent claim, if not paid

109 80 209 40 ** Reissue independent claims
over original patent110 18 210 9 ** Reissue claims in excess of 20
and over original patent

SUBTOTAL (2)

(\$) 0

**or number previously paid, if greater; For Reissues, see above

FEE CALCULATION (continued)**3. ADDITIONAL FEES**

Fee Code	Large Entity (\$)	Small Entity (\$)	Fee Description	Fee Paid
105	130	205	65 Surcharge - late filing fee or oath	
127	50	227	25 Surcharge - late provisional filing fee or cover sheet	
139	130	139	130 Non-English specification	
147	2,520	147	2,520 For filing a request for <i>ex parte</i> reexamination	
112	920*	112	920* Requesting publication of SIR prior to Examiner action	
113	1,840*	113	1,840* Requesting publication of SIR after Examiner action	
115	110	215	55 Extension for reply within first month	
116	390	216	195 Extension for reply within second month	
117	890	217	445 Extension for reply within third month	
118	1,390	218	695 Extension for reply within fourth month	
128	1,890	228	945 Extension for reply within fifth month	
119	310	219	155 Notice of Appeal	
120	310	220	155 Filing a brief in support of an appeal	
121	270	221	135 Request for oral hearing	
138	1,510	138	1,510 Petition to institute a public use proceeding	
140	110	240	55 Petition to revive - unavoidable	
141	1,240	241	620 Petition to revive - unintentional	
142	1,240	242	620 Utility issue fee (or reissue)	
143	440	243	220 Design issue fee	
144	600	244	300 Plant issue fee	
122	130	122	130 Petitions to the Commissioner	
123	50	123	50 Processing fee under 37 CFR 1.17(q)	
126	180	126	180 Submission of Information Disclosure Stmt	
581	40	581	40 Recording each patent assignment per property (times number of properties)	40
146	710	246	355 Filing a submission after final rejection (37 CFR § 1.129(a))	
149	710	249	355 For each additional invention to be examined (37 CFR § 1.129(b))	
179	710	279	355 Request for Continued Examination (RCE)	
169	900	169	900 Request for expedited examination of a design application	

Other fee (specify)

*Reduced by Basic Filing Fee Paid

SUBTOTAL (3)

(\$) 40

SUBMITTED BY

Name (PnnlType)	Thomas A. Jolly	Registration No. (Attorney/Agent)	39,241	Telephone	(509) 324-9256
Signature	<i>Thomas A. Jolly</i>	Date	11-22-2000		

WARNING: Information on this form may become public. Credit card information should not be included on this form. Provide credit card information and authorization on PTO-2038.

Burden Hour Statement: This form is estimated to take 0.2 hours to complete. Time will vary depending upon the needs of the individual case. Any comments on the amount of time you are required to complete this form should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, Washington, DC 20231. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Assistant Commissioner for Patents, Washington, DC 20231.

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

APPLICATION FOR LETTERS PATENT

**Improved Restricted Content Viewing Methods And
Arrangements For Use In A DVD Player**

Inventors:
Glenn F. Evans

ATTORNEY'S DOCKET NO. MS1-707US

RELATED APPLICATIONS

This patent application is related to co-pending U.S. Patents Numbers _____, (Attorney's Docket Numbers: MS1-703US, MS1-706US, MS1-688US, MS1-708US, and MS1-709US).

TECHNICAL FIELD

This invention relates to computers and like devices, and more particularly to improved restricted content viewing methods and arrangements for use between a multimedia player application and a generic media content navigator program via certain application programming interfaces (APIs).

BACKGROUND

A digital versatile disc (DVD) player is composed of three logical units, as defined in the DVD specification. The first logical unit is a DVD player application that presents an interface to the user and relays user commands to the second logical unit. The second logical unit is a DVD navigator that reads and interprets the information on the DVD and controls which segments of video and audio are processed based on the user commands. The third logical unit is a DVD presentation layer that decompresses data read from the DVD and presents the corresponding audio, video and subpicture streams, as applicable, to one or more renderers.

These logical units may be implemented in hardware and/or software. By way of example, in certain implementations, the DVD player is implemented via a graphical user interface (GUI) that is displayed to a user, and through which the user is able to selectively control playback, etc., of the DVD using a pointing

1 selection input device, e.g., a mouse. This is usually a fairly straightforward task
2 for system developers and allows for easy customization.

3 Implementing a DVD navigator, on the other hand, tends to be a more
4 complex task. This is especially true for applications that seek to integrate DVD
5 information into presentations and the like. Here, each developer entity would
6 need to provide a mechanism for reading and interpreting their DVD, and
7 interfacing with the decoder mechanism in the DVD presentation layer. Moreover,
8 the decoder mechanism in the DVD presentation layer will likely be a product of a
9 third party; making the task of authoring a DVD navigator even more difficult,
10 since the navigator must interface to many different decoder mechanisms.

11 Consequently, there is a need for a powerful yet simplified and consistent
12 interface that player applications can use to control the DVD navigator program.

13 14 **SUMMARY OF THE INVENTION**

15 Recognizing the potential burdens placed on application developers,
16 Microsoft Corporation, in an effort to further enhance their operating system and
17 the user's environment have developed a generic navigator component. This
18 generic navigator component provides a standard, specification-compliant DVD
19 navigator as part of Windows® to help application developers avoid such possibly
20 repetitive and difficult tasks. This generic navigator component exposes two
21 application programming interfaces (APIs) that combined provide a powerful, yet
22 simplified and consistent interface that player applications can use to control the
23 DVD navigator. The APIs have been designed to further influence the flexibility
24 and usefulness of the underlying DVD Navigator.

1 In accordance with certain aspects of the present invention, enhancements
2 have been developed to further extend the performance of the generic navigator
3 component. Of significance herein, was the need for improved mechanisms for
4 enforcing restricted/parental controlled viewing. In the past, the playback path of
5 the multimedia information could branch into one of two paths at a point when the
6 content exceeded the 'minimum parental level branching'. The failure branch is
7 taken if the current parental level is too low and the player application decides that
8 the user cannot change the level. Otherwise, the user is allowed to change to the
9 required parental level (e.g., via password) to allow going the presentation to
10 proceed down the success branch. The methods and arrangements provided herein
11 continue supporting the decision mechanism associated with this dual branching
12 operation and coordinating handling of parental level requests, while also
13 supporting a plurality of parental levels and a 'multi-segment parental level
14 branching' scheme. Moreover, with regard to the dual branching operations, the
15 methods and arrangements herein do not require that the movie, etc., be restarted
16 upon the successful increasing of the parental level.

19 **BRIEF DESCRIPTION OF THE DRAWINGS**

20 A more complete understanding of the various methods and arrangements
21 of the present invention may be had by reference to the following detailed
22 description when taken in conjunction with the accompanying drawings wherein:

23 Fig. 1 is a block diagram depicting an exemplary DVD player device.

24 Fig. 2 is a block diagram of a computer environment suitable for use with
25 the DVD player device in Fig. 1.

1 Fig. 3 is. a block diagram depicting a first mode of synchronization
2 between a DVD player application and a generic navigator program.

3 Fig. 4 is. a block diagram depicting a second mode of synchronization
4 between a DVD player application and a generic navigator program.

5 Fig. 5 is. a block diagram depicting a third mode of synchronization
6 between a DVD player application and a generic navigator program.

7 Fig. 6 is. a block diagram depicting a fourth mode of synchronization
8 between a DVD player application and a generic navigator program.

9 Figs 7 and 8 are block diagrams depicting non-blocking and blocking
10 modes of synchronization, respectively, between a DVD player application and a
11 generic navigator program.

12 Fig. 9 is a block diagram depicting exemplary read/write communication
13 functionality between a player application and a program related to media content.

14 Fig. 10 is a line diagram depicting a dual-branch playback decision point
15 associated with restricted/parental control over media content.

16 Fig. 11 is a line diagram depicting a multiple-branch playback decision
17 point associated with restricted/parental control over media content.

18 Fig. 12 is a block diagram depicting an exemplary method for controlling
19 access to media data through the use of a player application supplied code.

20 Fig. 13 is a block diagram depicting exemplary media content bookmarking
21 functionality.

22 Fig. 14 is an illustrative diagram depicting an exemplary method for
23 generating a substantially unique identifier for a media source.

24
25

DETAILED DESCRIPTION

The following exemplary methods and arrangements describe certain enhancements and features associated with a generic DVD navigator having APIs exposed to DVD player applications. These are referred to as the DVD navigator and DVD2 APIs. It is noted that while most of the description is directed towards a PC running the Windows® operating system, the various methods and arrangements are clearly applicable to other operating systems, devices, etc. Moreover, the use of the term DVD is not meant to exclude other media formats. Thus, the DVD content itself may come from a hard drive, a compact disc, over a network, and the like.

As will be described, the DVD navigator and/or DVD2 API enable a player application to interactively control the playback of DVD content. The DVD2 API consists of two interfaces. The first is termed "IDvdInfo2". The second is termed "IDvdControl2". The player application may use the IDvdInfo2 interface to query the current state of the DVD navigator and the IDvdControl2 interface to better control playback and/or to alter the DVD navigator's state.

The DVD2 API provides several unique and novel features. For example, thread-based synchronization methods are provided for real-time playback; a playback control mechanism is provided to determine the degree of interactivity; communication mechanisms are provided between the player application and the disc program, playing of time ranges is supported; mechanisms are provided for coordinating and handling parental level requests and for determining the minimal parental level to play a restricted segment of content; and, a unique disc identifier algorithm is provided, which further supports the bookmarking of any location within the DVD content

1 With this mind, attention is drawn to Fig. 1, which depicts an exemplary
2 DVD player 100. Player 100 includes at least one player application 102
3 configured to present the user with a user interface (U/I) 104. Through U/I 104,
4 the user is able to instruct player application 102 with regard to the playback of
5 DVD content 110.

6 As illustrated, player application 102 is provided with DVD2 API 108a and
7 108b to communicate user requests, and receive feedback information,
8 respectively. DVD2 API 108a-b provide access to the functions within navigator
9 106. Navigator 106 interacts with DVD content 110, which in addition to media
10 information includes a program 112. Program 112 defines the menus, jumps, etc.,
11 associated with the remaining content. Navigator 106 includes a state 114
12 associated with the playback process. Here, in state 114, for example, the current
13 user operation (UOP) (e.g., play, stop, pause, reverse, fast-forward, slow motion,
14 angle, etc.) is stored along with the current location within the DVD content (e.g.,
15 chapter, time, frame) and certain other registers such as those that could record
16 recent jumps/UOPs.

17 The output of navigator 106 includes an encoded video stream, an encoded
18 audio stream, and a subpicture stream, as applicable. These outputs are inputted to
19 a decoder 116, which is configured to decode (decrypt and decompress) the
20 encoded data and output the corresponding streams to the applicable video
21 renderer 118 or audio renderer 120. Renderer 118 causes the video information to
22 be displayed to the user, for example, via a video monitor. Renderer 120 causes
23 the audio information to be reproduced for the listener, for example, via one or
24 more speakers.

1 Attention is now drawn to Fig. 2, which is a block diagram depicting an
2 exemplary computing system 200 suitable for use with the arrangement in Fig. 1.

3 Computing system 200 is, in this example, in the form of a personal
4 computer (PC), however, in other examples computing system may take the form
5 of a dedicated server(s), a special-purpose device, an appliance, a handheld
6 computing device, a mobile telephone device, a pager device, etc.

7 As shown, computing system 200 includes a processing unit 221, a system
8 memory 222, and a system bus 223. System bus 223 links together various system
9 components including system memory 222 and the processing unit 221. System
10 bus 223 may be any of several types of bus structures including a memory bus or
11 memory controller, a peripheral bus, and a local bus using any of a variety of bus
12 architectures. System memory 222 typically includes read only memory (ROM)
13 224 and random access memory (RAM) 225. A basic input/output system 226
14 (BIOS), containing the basic routine that helps to transfer information between
15 elements within computing system 200, such as during start-up, is stored in ROM
16 224. Computing system 200 further includes a hard disk drive 227 for reading
17 from and writing to a hard disk, not shown, a magnetic disk drive 228 for reading
18 from or writing to a removable magnetic disk 229, and an optical disk drive 30
19 for reading from or writing to a removable optical disk 231 such as a CD ROM or
20 other optical media. Hard disk drive 227, magnetic disk drive 228, and optical
21 disk drive 230 are connected to system bus 223 by a hard disk drive interface 232,
22 a magnetic disk drive interface 233, and an optical drive interface 234,
23 respectively. These drives and their associated computer-readable media provide
24 nonvolatile storage of computer readable instructions, data structures, computer
25 programs and other data for computing system 200.

1 A number of computer programs may be stored on the hard disk, magnetic
2 disk 229, optical disk 231, ROM 224 or RAM 225, including an operating system
3 235, one or more application programs 236, other programs 237, and program data
4 238.

5 A user may enter commands and information into computing system 200
6 through various input devices such as a keyboard 240 and pointing device 242
7 (such as a mouse). A camera/microphone 255 or other like media device capable
8 of capturing or otherwise outputting real-time data 256 can also be included as an
9 input device to computing system 200. The real-time data 256 can be input into
10 computing system 200 via an appropriate interface 257. Interface 257 can be
11 connected to the system bus 223, thereby allowing real-time data 256 to be stored
12 in RAM 225, or one of the other data storage devices, or otherwise processed.

13 As shown, a monitor 247 or other type of display device is also connected
14 to the system bus 223 via an interface, such as a video adapter 248. In addition to
15 the monitor, computing system 200 may also include other peripheral output
16 devices (not shown), such as speakers, printers, etc.

17 Computing system 200 may operate in a networked environment using
18 logical connections to one or more remote computers, such as a remote computer
19 249. Remote computer 249 may be another personal computer, a server, a router,
20 a network PC, a peer device or other common network node, and typically
21 includes many or all of the elements described above relative to computing system
22 200, although only a memory storage device 250 has been illustrated in Fig. 2.

23 The logical connections depicted in Fig. 2 include a local area network
24 (LAN) 251 and a wide area network (WAN) 252. Such networking environments
25

1 are commonplace in offices, enterprise-wide computer networks, Intranets and the
2 Internet.

3 When used in a LAN networking environment, computing system 200 is
4 connected to the local network 251 through a network interface or adapter 253.
5 When used in a WAN networking environment, computing system 200 typically
6 includes a modem 254 or other means for establishing communications over the
7 wide area network 252, such as the Internet. Modem 254, which may be internal
8 or external, is connected to system bus 223 via the serial port interface 246.

9 In a networked environment, computer programs depicted relative to the
10 computing system 200, or portions thereof, may be stored in the remote memory
11 storage device. It will be appreciated that the network connections shown are
12 exemplary and other means of establishing a communications link between the
13 computers may be used.

14 DVD2 API 108a-b simplifies application authoring, adds functionality and
15 solves many difficult synchronization issues common to DVD player applications
16 development. Basically, a common DVD API helps discourage proprietary single-
17 use monolithic DVD solutions that serve only as standalone DVD player
18 applications. It also allows various applications (such as presentation programs,
19 DVD players, games, or interactive learning programs) to add DVD support
20 without having to know which DVD decoder or DVD hardware support is on the
21 user's system. Historically, custom DVD solutions tend to be very hardware
22 dependent and have limited upgrade options for users.

23 As will be described in greater detail below, DVD2 API 108a-b adds
24 flexible synchronization mechanisms for the application to know the completion
25 status of requests made to the DVD Navigator 106. The new command completion

1 notification allows the application to concurrently perform other tasks and be
2 informed of the status of a previous request. Previous DVD APIs assumed that
3 either the application would be blocked until the request was completed, or would
4 not send any notification to the application. Applications now have the option of
5 receiving a synchronization object that they can use to wait on or are notified
6 about completion events.

7 The synchronization mechanism also returns the status of the request that
8 indicates whether it succeeded or returns the reason (an error code) for its failure.
9 Previous DVD APIs would appear to successfully execute requests that would
10 later fail due to changed state when the DVD Navigator 106 actually started
11 processing them. At that point, there was no way to propagate the error indication
12 back to the player application102. The new mechanism also notifies the player
13 application 102 of every request that is cancelled or overridden by the disc's
14 program 112 or by further user actions.

15 Current DVD APIs use predefined behaviors that dictate how a command
16 interacts with the current display. When a player application issues a new request,
17 it pre-empts and cancels any content (video or audio) that is being played.
18 Alternatively, the APIs semantics dictate that the current presentation completes
19 before the new content is presented which forces the user to wait before he/she can
20 request another action. Interactive applications such as DVD players and games
21 may require the first behavior (instant effect), but other applications such as a
22 slideshow may require the second behavior (complete the current presentation).
23 Since these two options are mutually exclusive, predefined API's semantics cannot
24 accommodate both. DVD2 API 108a-b allows player application 102 to indicate
25

1 the desired behavior via flags, and also how it interacts with the synchronization
2 mechanism.

3 DVD navigator 106 is configured to simulate a virtual CPU that uses an
4 execution state 114 (in the form of a set of memory registers 124 (see, Fig. 9)).
5 Previous DVD APIs allowed applications to read the contents of the registers.
6 DVD2 API 108a-b also allows player application 102 to also change the contents
7 of the memory registers. The combined read/write functionality allows player
8 application 102 to essentially 'communicate' with program 112, as illustrated in
9 Fig. 9.

10 The read and write methods works in such a way that they can also be used
11 for synchronization. By way of example, with read/write functionality, player
12 application 102 can implement 'controlled unlocking' or restricted access to all or
13 portions of DVD content 110. With controlled unlocking, the user may be
14 restricted from viewing portions of the disc until player application 102 sets
15 specific memory registers. Player application 102 could receive this information
16 from the content's author, the user, another program, a website, or the like. For
17 example, Fig. 12 depicts the use of a code being written to registers 124 by player
18 application 102 and being read by program 112. If the code is correct, then
19 portion 130 of DVD content 110 can be played back.

20 In certain implementations, DVD2 API 108a-b contains a simplified
21 naming scheme for the potential user operations suggested in the DVD
22 specification Annex J. The DVD2 API uses less DVD jargon and features a more
23 intuitive naming scheme. The user operation names proposed in the DVD
24 specification are unclear and can lead to incorrect usage or under-utilization by
25 application programs. The names now suggest their usage instead of an abstract

1 label. Also time codes are now returned in a simple integer format instead of the
2 awkward BCD coding.

3 Some previous DVD APIs failed to correctly handle minimum parental
4 level branching by having the DVD navigator send an error event indicating that
5 the branch always failed (see Fig. 10). The player application then had to increase
6 the parental level and restart the movie from the beginning. If the branch fails, the
7 player application would need to stop the playback to enter the STOP domain to
8 change the parental level. It can only continue by restarting the movie.

9 To the contrary, DVD2 API 108a-b has a mode that pauses navigator 106
10 and lets player application 102 respond to the parental level increase request
11 before the navigator 106 continues. If the increase request is granted, the playback
12 continues without requiring the user to start the movie from the beginning. The
13 DVD specification only states that the navigator should pause until it knows
14 whether the request succeeded or failed. It does not describe a mechanism to
15 accomplish this task and suggests that the Navigator "calls the Temporary Parental
16 Level Change feature built into the player" (4.6.4.1 V14-197).

17 Nor does the DVD specification describe any mechanism to allow the user
18 to play multi-segment parent level branches (see, e.g., Fig 11). As such, previous
19 DVD APIs did not provide a mechanism that allowed the user to play multi-
20 segment (or multiple-branch) parent level branches if no branches were permitted
21 at the current user level. In the past, the navigator only notified the application
22 that the playback has stopped, since no branch was available for the current
23 parental level.

24 To the contrary, navigator 106 and DVD2 API 108a-b compute the
25 minimum level required to play the block and return this value along with a

1 playback stopped' notification. The application can then notify the user of the
2 required parental level that is required to continue playing DVD content 110.
3 Thus, the user no longer has to guess the required level through trial and error,
4 having to restart the movie on each try.

5 Additionally, DVD2 API 108a-b extends the functionality of the DVD
6 Annex J specification and previous DVD APIs. The DVD Annex J specification
7 only specifies actions to perform. It does not specify how player application 102
8 finds out information about the disc or the DVD navigator's state 114. Here, new
9 disc and navigation state query functionality is provided.

10 Unlike previous DVD APIs, DVD2 API 108a-b does not require the
11 application writer to already have a ready copy of the DVD specification to use it
12 (e.g., due to the incomplete description of the data returned by the API). The data
13 returned by the methods to get the textual information, the title attributes, audio
14 attributes and subpicture attributes is documented so that application developers
15 can get the necessary information from the new API and the associated
16 documentation.

17 DVD2 API 108a-b also allows the application to query the attributes of
18 arbitrary title indices instead of just the current title index. DVD2 API 108a-b also
19 returns the audio stream's Karaoke information so that intelligent Karaoke
20 applications can be implemented. DVD2 API 108a-b also returns the capabilities
21 of decoder 116 so the application can present configuration options to the user
22 (like frame stepping in both direction, smooth rewind and fast-forward etc.) or
23 intelligently alter the user interface. New control functionality is also provided.
24 For example, DVD2 API 108a-b allows player application 102 to play ranges of
25 chapters or ranges of times, to select specific menu buttons (just not relative

1 buttons) and allows the user to select buttons using a mouse location. It also
2 supports the getting/setting of bookmark objects and the ability to query a
3 calculated current unique disc ID.

4 To better understand the synchronization mechanism of the DVD2 API
5 108a-b and the associated navigator 106, with the application the following
6 sections examine various exemplarily modes of operation and point out some of
7 the benefits and shortcomings. Essentially, there are four modes of operation,
8 along with certain other variations thereto. The initial four modes are illustrated in
9 Figs. 3 through 6. Each of these modes may be supported by the various methods
10 and arrangements in accordance with the present invention.

11 A "don't care" mode or model is depicted in Fig. 3, wherein player
12 application 102 sends a request to navigator 106, without caring about what the
13 result, if any, there is, and/or when the request is completed. An example might be
14 a jump to location request, a show menu request, etc. Here, player application
15 essentially assumes that the requested operation has been completed.

16 In Fig. 4, an event mode or model is illustrated. Here, player application
17 102 is provided notice upon a generic event sent by the navigator (when the
18 request is completed). One drawback to this model is that player application 102
19 may have made more than one request and would not be able to tell the events
20 apart.

21 An improvement is provided in Fig. 5. Here, rather than having an event
22 provide notice to player application 102, navigator 106 generates an object that
23 can then be used by player application 102 to track the status of the request. This
24 provides player application 102 with the ability to conduct instance tracking.
25

1 In yet another improvement, as illustrated in Fig. 6, navigator 106 can
2 generate an object that can be used for tracking and also a subsequent event. In
3 this manner, player application 102 can use the objects to tell events apart.
4 Therefore, this model supports multiple instance tracking.

5 Before describing further details of these various models and the DVD2
6 API 108a-b, the deficiencies of a blocking-only API or a non-blocking-only API
7 will be described. One variation is depicted in Fig. 7. Here, player application
8 102 sends a request to navigator 106 (via DVD2 API 108a, of course). The player
9 application 102 must wait for a result message from navigator 106. One drawback
10 to this model is that U/I 104 will probably be "frozen" while player application
11 102 waits.

12 One way to solve the frozen U/I problem is to provide a worker program,
13 such as is depicted in Fig. 8. Here, the worker program receives the request and
14 forwards it to navigator 106 and then itself waits for the result message. Once the
15 worker receives the result message then it is forwarded to player application 102.
16 While this may free up U/I 104, it may be difficult to manage several workers
17 operating simultaneously.

18 In contrast, a non-blocking API is equivalent to the "don't care" mode.
19 There is no direct feedback on the status or result of an operation. The application
20 must infer the status from changes in the playback (time changes, menu changes,
21 etc). However, due to variation in disc content and structure, this approach is very
22 unreliable and error prone. With this mind, the following sections provide
23 additional details into the use of DVD2 API 108a-b

24 All of the IDVDControl methods in previous DVD APIs run
25 asynchronously to the application (a non-blocking-only model). Thus, when an

1 application 102 calls a method, the navigator 106 performs preliminary
2 verifications and then immediately returns a result. However, in the meantime, the
3 state of the DVD Navigator may have changed and the request may fail when the
4 DVD Navigator actually begins to execute the command.

5 One solution is to change the semantics of the DVD API to ensure that
6 methods do not return until all requests complete. But to retain the asynchronous
7 behavior, applications must create separate execution paths (e.g., helper threads) to
8 manage DVD API calls (as described above in a blocking-only model).
9 Multithreaded programming models always complicate application development,
10 especially simple scriptable interfaces.

11 Therefore, to solve this problem, the DVD2 API 108a-b creates associated
12 synchronization command objects. The command object allows the application to
13 synchronize and to learn about the command's status. Each API method is
14 extended with two extra arguments. The general form of a DVD2 API command
15 is:

16 HRESULT IDVDControl2::Command(arguments, dwFlags, IDvdCmd** ppObj)

17 Wherein: ppObject is an argument used to return a synchronization COM
18 (Component Object Model) object to application 102; and, dwFlags is the set of
19 flags passed to the method to determine the behavior and usage of the
20 synchronization object. These are a bit-wise union of the available pre-defined
21 flags.

22 The synchronization object has the following interface:

23 interface IDvdCmd : IUnknown

24 {

25 HRESULT WaitForStart();

1 HRESULT WaitForEnd();

2 }

3 The object returned must be released by the application. By returning a pre-
4 incremented COM object, the life of the object can be correctly maintained. A
5 variation on the interface also extends the original interface by including two
6 methods that allow the application to wait on the start and end occurrence along
7 with other changes in the system:

8 HANDLE GetStartHandle();

9 HANDLE GetEndHandle();

10
11 The flags take the following values:

12 DVD_CMD_FLAG_SendEvents - events are sent regarding the request's
13 status

14 DVD_CMD_FLAG_Block - do not continue until the command has been
15 completed

16 DVD_CMD_FLAG_None - a placeholder indicating no flags

17 The special return code VFW_E_DVD_CMD_CANCELLED is returned
18 by the initial DVD API method, by the IDvdCmd::WaitForStart or
19 IDvdCmd::WaitForEnd or along with the event indication that the command was
20 pre-empted and is no longer valid.

21 A sample example of C++ usage of a command object is as follows:

22 IDvdCmd* pObj ;

23 HRESULT hres = IDvdControl2->PlayTitle (15, DVD_CMD_FLAG_None ,&pObj);

24 // don't wait or notify

25 pObj ->Release () ;

As described above, player application 102 can determine the commencement and completion of the command, by any of the following: using the command object directly, using no command objects, listening to command related events, using a combination of events and objects to aid in tracking multiple instances of a command.

Using objects

By passing an IDvdCmd pointer to the command, the Navigator will allocate and return a new IDvdCmd object. Calling the interface method IDvdCmd::WaitForStart() will block until the command begins and IDvdCmd::WaitForEnd() waits until the command completes. If the command has been cancelled, then the Navigator will return VFW_E_COMMAND_CANCELLED. After the application is done with the object, it must call Release() to free the COM object. A NULL pointer passed to the DVD API indicates that no command object should be returned to the application and the command execution should continue in the standard asynchronous mode.

The other two methods GetStartHandle() and GetEndHandle() return a system specific synchronization object that allows the application to wait for other requests (disc I/O, user interface changes, semaphore changes, unblocking threads, communications with other processes, etc) to be processed while it wait for the start or end events to occurs. Then the application calls the WaitForStart() or WaitForEnd() methods to retrieve the result. An example in the Microsoft Windows API:

```
handleStart = GetStartHandle()
```

```
Signaled = WaitForMultipleObjects( handleDiscIO, handleUserInter, ..., handleStart )
```

1 If signaled = handleStart

2 Result = DvdCmd->WaitForStart()

4 **Not using Objects**

5 Instead of managing an object, the application can simply specify the
6 DVD_CMD_FLAG_Block flag with a null object pointer. The command will not
7 return until it has either completed or was cancelled. The API will emulate a
8 synchronous behavior. For example:

9 HRESULT hres = IDvdControl2->PlayTitle(uTitle, DVD_CMD_FLAG_Block,0);

10 is semantically equivalent to:

11 IDvdCmd* pObj ;
12 HRESULT hres = IDvdControl2->PlayTitle(uTitle,
13 DVD_CMD_FLAG_Block, &pObj);
14 If(succeeded (hres)) {
15 Hres = pObj->WaitToEnd();
16 pObj->Release();
17 }

14 **Using Events**

15 Specifying the DVD_CMD_FLAG_SendEvents flag will cause the
16 Navigator to issue the following events:

17 {EC_DVD_CMD_START, lParam1, HRESULT}

18 {EC_DVD_CMD_END, lParam1, HRESULT}

19 If an application only needs to synchronize one command (or does not
20 differentiate between command instances), no synchronization object is needed
21 and only events are required. A NULL object pointer is passed to the DVD API
22 method and the lParam1 value sent with the event will always be set to 0.

23 **Using Events and Objects**

By specifying both objects and the DVD_CMD_FLAG_SendEvents flag, an application can track different commands. The DVD2 API call will return an object that the application can use for later reference. When the event notification is sent, the DVD2 API generates a unique identifier (or 'cookie') IParam1 for each event that the application can map back to an IDvdCmd object. The cookie approach ensures that applications will not leak memory if they miss an event and allows the DVD Navigator to verify the validity of the object.

The DVD2 API method IDvdInfo2::GetCmdFromEvent(IParam1) maps the cookie into a command object pointer. The application must call the COM "Release" method on the returned pointer after it has finished processing each of these events. When the application is completely finished with the message (usually after receiving an END event), it must call "Release" on the global command pointer that it saved.

Example of Blocking/Non-Blocking

The following illustrative examples show how synchronization can be accomplished using the IDvdControl2 interface:

For clarity, some of the examples refer to the following utility function used to map the IParam1 value from EC_DVD_CMD events into an IDvdCmd object:

```
IDvdCmd* GetDvdCmd( LONG_PTR IParam )
{
    IDvdCmd* pCmd;
    plDvdInfo2->GetCmdFromEvent( iParam, &pCmd );
    return pCmd;
}
```

No synchronization (Asynchronous model)

The application calls the method to request an action:

```
HRESULT hres = IDvdControl2->PlayTitle( uTitle, 0, NULL);
```

Synchronization without events

1 An example of the correct way to wait for a command to end without using
2 events is:

```
3       IDvdCmd* pObj ;  
4       HRESULT hres = IDvdControl2->PlayTitle( uTitle, 0, &pObj);  
5       If( SUCCEEDED) hres)) {  
6             pObj ->WaitToEnd ( ) ;  
7             pObj ->Release ( ) ;  
8       }
```

9 **Partial synchronization using events**

10 To synchronize a single event without managing IDvdCmd objects:

```
11       HRESULT hres = IDvdControl2->PlayTitle( uTitle,  
12             DVD_CMD_FLAG_SendEvents, NULL);  
13       Function ProcesEvent( type, lParam1, lParam2 )  
14       {  
15             switch( type )  
16             {  
17                 case EC_DVD_CMD_END:  
18                     HRESULT hres = lParam2; // result code is in lParam2  
19                     break;  
20             }  
21       }
```

22 **Full synchronization using events**

23 An example of the correct way to wait for a command using events is:

24 // in global code

```
25       IDvdCmd* pGlobalObj = 0 ;
```



```

1      // Note: pGlobalObj is assigned by the Navigator BEFORE the event
2
3      // is issued; otherwise the event can occur at point (*1) before
4
5      // pGlobalObj is initialized.
6
7      HRESULT hres = IDvdControl2->PlayTitle( uTitle,
8
9      DVD_CMD_FLAG_SendEvents, &pGlobalObj );
10
11      // (*1)
12
13      If( FAILED ( hres)) {
14
15          pGlobalObj = NULL;
16
17      }
18
19      ...
20
21      In the event processing function:
22
23      Function ProcessEvent( type, lParam1, lParam2 )
24
25      switch (type)
26
27      {
28
29      case EC_DVD_CMD_END:
30
31          IDvdCmd* pObj = GetDvdCmd( lParam1 ) ;
32
33          HRESULT hres = lParam2;
34
35          If( NULL != pObj ) {
36
37              // if the object returned by the event matches the global pointer returned
38
39              // by the PlayTitle, process it
40
41              If (pGlobalObj == pObj ) {
42
43                  ProcessCmdEnd....
44
45                  pGlobalObj ->Release ( ) ;
46
47                  pGlobalObj = NULL;
48
49              }
50

```

```

1         pObj ->Release ( );
2     }
3     break ;
4

```

Full synchronization using events and a separate event loop thread

An example of the correct way to wait for a command using events is:

```

7 // in global code
8 IDvdCmd* pGlobalObj=0;
9 {
10     LockCriticalSection
11     HRESULT hres = IDvdControl2->PlayTitle( uTitle,
12         DVD_CMD_FLAG_SendEvents, &pGlobalObj );
13     If( FAILED ( hres)) {
14         pGlobalObj = NULL;
15     }
16     UnlockCriticalSection
17 }

```

Function ProcessEvent(type, lParam1, lParam2)

```

14 switch (type)
15 {
16     case EC_DVD_CMD_COMPLETE:
17     case EC_DVD_CMD_CANCEL:
18     {
19         CautoLock(globalCritSect );
20         IDvdCmd* pObj = GetDvdCmd( lParam1 );
21         HRESULT hres = lParam2
22         If( NULL = pObj ) {
23             If (pGlobalObj == pObj ) {
24                 pGlobalObj ->Release ( );
25                 pGlobalObj = NULL;
26             }
27             pObj ->Release ( );
28         }
29         break ;
30     }
31 }

```

Exemplary Playback Interactivity Control Mechanism

Previous DVD API commands assumed that on any change of content, player application 102 wanted to truncate the current content presentation, and it

switched to the new content. The improved DVD2 API commands extend the command object mechanism with the following flags:

DVD_CMD_FLAG_Flush

DVD_CMD_FLAG_StartWhenRendered

DVD_CMD_FLAG_EndAfterRendered

Here, the .._Flush flag indicates that the presentation of the current content should be immediately truncated so that new content can start to be displayed (like before). The absence of the flag indicates that the current content presentation should end first. The ..._..Rendered flags change the semantics of the start and end of each command. By default, the command starts and ends once it has been processed. The new flags indicate that the start and end occur when the results of the change of content have been processed and presented respectively.

Exemplary Disc Communication Mechanism

DVD2 API 108a-b permits player applications not only to read the DVD Navigator's general purpose registers (the GPRMs), but also allows them to set the GPRMs using:

```
IDvdInfo2::GetAllGPRMs(WORD pwRegisterArray[16] )
```

```
IDvdControl2::SetGPRM( ULONG ulindex, WORD wValue, DWORD dwFlags,  
IDvdCmd** ppCmd)
```

The combined read/write functionality allows DVD applications to 'communicate' with the program on the disc and can implement 'controlled unlocking' or restricted access to the content. The application can use GetAllGPRMs to read the current state and set a specific register using SetGPRM.

The SetGPRM method can also be used to synchronize the application and the DVD Navigator's virtual CPU. The SetGPRM method is executed only during

1 the periods when the DVD Navigator is allowed to process user commands (the
2 Presentation and Still phases, 3.3.6.1 V13-28). Navigation command execution is
3 considered to be atomic. So setting the GPRM is postponed until these phases
4 occur. The application can use the command object and event mechanism to
5 ensure coordination. The command object's event mechanism is serialized with
6 event notifications (such as domain changes or changes to system registers). The
7 application can call SetGPRM and wait until the command completion event is
8 received, and then wait for an event indicating a change the DVD navigator's state
9 (possibly a domain change).

10 One such way to accomplish disc to application communication is
11 illustrated by the following pseudocode:

12 Disc sends data and awaits reply:

13 Disc alters a GPRM value (using a on-disc navigation command)

14 Disc changes its state (e.g. changes its domain)

15 Loops waiting for a GPRM change (caused by the application)

16 Application receives GPRM data and replies:

17 Waits for the state change (e.g. the disc's domain change)

18 Reads GPRM value

19 Sets a GPRM value using SetGPRM

20 One such way to accomplish application to disc communication is
21 illustrated by the following pseudocode:

22 Application sends data and awaits acknowledgement:

23 Application sets the data using SetGPRM

24 Application waits for a domain change before continuing

25 Disc receives data and returns acknowledgement:

Disc reads GPRM

Disc changes its state (e.g. changes its domain)

Exemplary Query (Info) Interfaces

Even though the DVD specification does not suggest any data retrieval methods, the DVD2 APIs do provide this capability. The following is a list of methods provided:

```
GetAllGPRMs
GetAllSPRMs
GetAudioLanguage
GetCurrentAngle
GetCurrentAudio
GetCurrentButton
GetCurrentDomain
GetCurrentLocation
GetCurrentSubpicture
GetNumberOfChapters
GetPlayerParentalLevel
GetSubpictureLanguage
GetTotalTitleTime
GetTitleParentalLevels
GetCurrentUOPS
GetCurrentVolumeInfo (IDVD1::GetDVDVolumeInfo)
GetDVDDirectory (IDVD1::GetRoot)
GetAudioAttributes( [in] ULONG ulStream, [out] DVD_AudioAttributes *pATR );
GetCurrentVideoAttributes( [out] DVD_VideoAttributes * pATR );
GetVMGAttributes( [out] DVD_MenuAttributes * pATR );
GetTitleAttributes( ULONG ulTitle, [out] DVD_MenuAttributes * pMenu, [out]
DVD_TitleAttributes* pTitle );
GetSubpictureAttributes( [in] ULONG ulStream, [out] DVD_SubpictureAttributes
*pATR );
GetButtonAtPosition( POINT point, [out] ULONG *puButtonIndex );
GetButtonRect( ULONG ulButton, RECT *pRect );
GetDefaultAudioLanguage( LCID* pLanguage, DVD_AUDIO_LANG_EXT*
pAudioExt );
GetDefaultMenuLanguage( LCID* pLanguage );
GetDefaultSubpictureLanguage( LCID* pLanguage,
DVD_SUBPICTURE_LANG_EXT*pSubpictureExtension );
GetDVDTextLanguageInfo( ULONG ulLangIndex, ULONG* pulNumOfStrings,
LCID*pwLangCode, DVD_TextCharSet * pbCharacterSet );
GetDVDTextNumberOfLanguages( ULONG * pulNumOfLangs );
GetDVDTextStringAsNative( ULONG ulLangIndex, ULONG ulStringIndex, BYTE*
pbBuffer,ULONG ulMaxBufferSize, ULONG* pulActualSize, enum
DVD_TextStringType* pTyp );
```

```

1  GetDVDTextStringAsUnicode( ULONG ulLangIndex, ULONG ulStringIndex,
2  WCHAR*pchBuffer, ULONG ulMaxBufferSize, ULONG* pActualSize,
3  DVD_TextStringType* pType );
4  GetCmdFromEvent( LONG_PTR dwID, IDvdCmd** ppCmd );
5  GetDecoderCaps( DVD_DECODER_CAPS *pCaps );
6  GetDiscID( LPCWSTR pszPath, ULONGLONG* pullUniqueID );
7  GetKaraokeAttributes( [in] ULONG ulStream, DVD_KaraokeAttributes *pATR );
8  GetMenuLanguages( LCID *pLang, ULONG uMaxLang, ULONG *puActualLang );
9  IsAudioStreamEnabled( ULONG ulStreamNum, BOOL *pbEnabled );
10 IsSubpictureStreamEnabled( ULONG ulStreamNum, BOOL *pbEnabled );

```

Exemplary Control Interfaces

1) Period Playback Interface

In addition to playing ranges of chapters, the DVD2 API allows the playing of time periods using:

```

10 PlayPeriodInTitleAutoStop(ULONG ulTitle, DVD_HMSF_TIMECODE* pStartTime,
11 DVD_HMSF_TIMECODE* pEndTime, DWORD dwFlags, IDvdCmd** ppCmd )

```

With this method, applications (such as video editing programs and games) can accurately playback arbitrary portions of the content. Combined with the command object mechanism, any application like slideshow presentation, video games interludes, or kiosks can be implemented using a single DVD2 API command.

2) Default language Interfaces

```

18 SelectDefaultAudioLanguage(LCIDLanguage,DVD_AUDIO_LANG_EXT
19 audioExtension)

```

```

20 SelectDefaultSubpictureLanguage(LCIDLanguage, DVD_SUBPICTURE_LANG_EXT
21 subpictureExtension )

```

These methods allow applications (from user) to set the default language choices for DVD playback.

3) Button index selection

Applications can now automate menu navigation through the method

SelectButton(ULONG ulButton)

4) Bookmarking APIs

Applications can save and restore the entire DVD state (see bookmark patent)

GetState(IDvdState **pStateData)

SetState(IDvdState* pState, DWORD dwFlags, [out] IDvdCmd* ppCmd)

5) Other

AcceptParentalLevelChange(BOOL bAccept) – Please refer to the following "Minimum parental level branching" section.

SetGPRM(ULONG ulindex, WORD wValue, DWORD dwFlags, [out] IDvdCmd** ppCmd) -

SetOption(DVD_OPTION_FLAG flag, BOOL bEnable) - extendible option setting mechanism

Mechanism for coordinating minimum parental level branching

According to the DVD specification (section 4.6.4.1 pV14-197), when the DVD Navigator encounters a 'SetTmpPML' (set temporary parental management level) command, it should request permission from the application ("call the Temporary Parental level Change feature built into the player") to temporarily raise the current level. If the parental level change is allowed, the Navigator raises the parental level and branches to the restricted piece of content. Otherwise, it continues with the next command.

Under the semantics of the previous DVD API, when the DVD navigator executes a SetTmpPML instruction, it only sends a PARENTAL_LEVEL_TOO_LOW event to the application. It immediately

continues on executing the next command as if the parental level change failed. The application receives the event, stops the playback, displays a user interface to change the parental level, and then restarts the movie from the beginning. According to the DVD specification, the Navigator is allowed to alter the parental level only when it is in the STOP Domain. As a result, since the navigator does not pause at the change it must stop the playback.

With DVD2 API 108a-b, for example, the following sequence may occur. The application notifies the API of the availability of the parental level change feature by calling the method:

```
IDVDControl2::SetOption( DVD_NotifyParentalLevelChange, TRUE)
```

When the DVD Navigator encounters a SetTmpPML instruction, it sends a PARENTAL_LEVEL_TOO_LOW event to the application. The application is expected to display some user interface to let the user increase the parental level. The DVD Navigator blocks until the application responds by calling IDVDControl2::AcceptParentalLevelChange() with TRUE or FALSE, and then proceeds accordingly without having to stop the playback.

Mechanism for aiding playback of multi-segment parental level branches

The DVD specification (Section 4.1.4.1 V14-22) describes a scheme for selecting different program chains (usually different possible segments of content) based on the current parental level. For example, at a certain point in the video, different versions of a scene could be available and are automatically selected by the navigator based on the parental level (e.g. segments intended for PG, R rated or children).

For each title, the PTL_MAI table maps the current parental level into a 16-bit mask. During playback, the DVD Navigator obtains the current parental bit mask from the PTL_MAI table. The parental bit mask is used when the Navigator encounters a parental block (a collection of program chains in which each program chain has an exclusive parental bit mask). The Navigator searches each PTLID_FLD in the VTS_PGCI_SRP (Section 4.2.3 V14-62) for a program chain with a bit mask that shares common bits with the current parental bit mask.

If no program chain partially matches the current bit mask, previous versions of the DVD Navigator would halt the playback and send a DVD_ERROR_LowParentalLevel event to the application.

To help the user, certain exemplary implementations of DVD2 API 108a-b uses the following algorithm to compute the minimum required parental level that would let the user continue:

Initialize $PTL_MASK = 0$ (the possible allowed parental levels)

For each program chain index i in the VTS_PGCI_SRP

If $VTS_PGCI_SRP[i].BlockType = 1$ (in a parental block)

$PTL_MASK = PTL_MASK \text{ union } VTS_PGCI_SRP[i].PTL_ID_FLD$

If $PTL_MASK = 0$ then

no parental level is present, so any level will work

Else

for each parental level index i in the PTL_MAI

Let $PTL_LVLI = PTL_MAI[8 - i]$

If $PTL_LVLI[title_index] \& PTL_MAI[8 - i] = 0$

(note: $title_index = 0$ in the VMGM domain)

Return i

1 The index i is returned along with the DVD_ERROR_LowParentalLevel
2 event. The application 102 can use the index to suggest a possible parental level
3 setting to the user.
4

5 **Bookmarking**

6 DVD navigator 106 is configured to allow a player application 102 to
7 encode and store the current state 114 of the DVD playback into an abstract object
8 (referred to a bookmark 150) containing a persistent block of data. Fig. 13 depicts
9 exemplary bookmarking functionality.

10 To further abstract and simplify the usage, DVD2 API 108a-b is configured
11 to save, restore and query the state information contained in the bookmark. Player
12 application 102 can query information in the bookmark 150 using the navigator
13 106 and save it for later use. Player application 102 can later resume playback by
14 instructing the DVD navigator 106 to restore the DVD playback state 114
15 contained in the bookmark. Restoring bookmarks allows the player application to
16 start playing from any arbitrary location, and any number of them for a DVD
17 content 110. The bookmarks can be stored either in short term (memory) storage
18 or long term storage (for example, a hard drive), and can be restored even after
19 player application 102 and/or the PC has been shutdown and restarted. The
20 bookmark not only contains the state of the DVD navigator (such as internal
21 register values, playback location, playback state) but also the information about
22 the current disc content being played and the user's settings. Player application
23 102 can use this extra information to intelligently select the appropriate bookmark
24 from previously saved ones that can be played for a particular disc (usually the
25

disc being played), for example. Bookmarks can be also be shared between users and between various applications

The bookmarking abstract data type is comprised of two aspects; 1) the actual bookmark 150 itself, and 2) the API calls used to save, restore and query information contained in the bookmark. In accordance with certain exemplary implementations, bookmark 150 contains at least the following information: a substantially unique disc identifier 145, the address of the current video object unit (VOBU) being displayed (section 5.1.1 of the DVD specification), the loop count and shuffle history (Section 3.3.3.2 of the DVD specification), the current DVD resume information (outlined in section 3.3.3.2 of the DVD specification), the current DVD general parameter (GPRM) and system parameter (SPRM) values (sections 4.6.1.1 and 4.6.1.2), and the current domain and phase (section 3.3.3 and 3.3.6). In certain further implementations, the bookmark also includes versioning and integrity information. The bookmark 150 can be packaged as an abstract object or as a block of binary data for storage.

To provide such bookmarking techniques, DVD2 API 108 in certain exemplary implementations supports the following methods:

1. To create a bookmark from the current location
Bookmark = GetBookmark()
2. To cause the DVD Navigator to change its location to the bookmark
SetBookmark(bookmark)
3. To find out the disc that a bookmark is intended for
DiscID = GetDiscIdentifierFromBookmark(bookmark)
4. To convert a bookmark to and from its binary representation:
BinaryData(data,size) = ConvertBookmarkToBinary(bookmark)

1 Bookmark = ConvertBinaryToBookmark(BinaryData)
2 Application pseudocode to implement storing the current location or to
3 implement power saving functionality (i.e. the ability to save the computer's state
4 to enter a low power state that can be restored):

5 Bookmark = GetBookmark()
6 BinaryData(data,size) = ConvertBookmarkToBinary(bookmark)
7 Store BinaryData(data,size)
8 Shutdown or enter power saving

9 On return from power saving, do the following to resume playback of
10 DVD:

11 Retrieve BinaryData(data,size)
12 Bookmark = ConvertBinaryToBookmark(BinaryData)
13 If GetDiscIdentifierFromBookmark(bookmark) = current Disc Id
14 Then
15 SetBookmark(bookmark)

16
17 An example of pseudocode for an application to implement intelligent
18 bookmarks

19 For each stored bookmark "bookmark"
20 If GetDiscIdentifierFromBookmark(bookmark) = current Disc Id
21 Then
22 Add bookmark to the user selectable list

23
24
25 **Unique Identifier Generation**

1 The current DVD specification has a built-in unique identifier on each disc
2 ("DVD unique identifier"). However, applications must assume that the disc
3 authors correctly implemented the identifier; unfortunately, this not always so.

4 Many applications need a unique tag to identify a DVD disc, such as when
5 a user swaps DVD discs, the playback system needs to decide if it has a new disc.
6 If it has a new disc, then it must reset the playback, otherwise it can continue
7 without interrupting the user's viewing. If it does not have the ability to
8 differentiate discs, it must always reset. A unique identifier 145 (see, Fig. 13)
9 would provide the ability to differentiate different discs (not different exact copies,
10 however).

11 A unique identifier 145 also lets applications verify the compatibility of
12 stored information with a particular DVD disc. Applications cannot successfully
13 use cached information with the wrong disc. For example, when a user attempts to
14 recall a saved location on the disc using a bookmark, the DVD navigator 108 can
15 ensure the data's compatibility by comparing the unique identifier stored in the
16 bookmark with the unique identifier of the current disc. Playback only continues
17 if the identifiers match.

18 Unique identifiers 145 allow applications to associate additional
19 information with the disc by using the unique identifier as an index into a
20 database. For example, even though the DVD specification supports textual
21 information on the disc, it is rarely used. A web-based database of the disc's title
22 and contents can be stored and retrieved by an application after it computes the
23 identifier on the disc.

24 The current built-in unique identifier on the DVD disc is inadequate. First,
25 the identifier is relatively large in size (32 bytes), it relies on the disc author to

1 ensure that it is actually unique, and a central entity must assign ranges of
2 identifiers to disc authors to ensure that the uniqueness is maintained between
3 companies.

4 Other conventional "unique" identifier algorithms do not produce unique
5 identifiers for a large numbers of discs. Here, the probability that two discs are
6 assigned the same identifier grows exponentially as the total number of DVD discs
7 increases. With the expected growth trends in DVD discs, many 'unique' identifier
8 routines will be inadequate. Moreover, these algorithms often do not have known,
9 and/or provable properties. Without known properties, it is impossible to state the
10 effectiveness or suitability of the identifiers produced.

11 In accordance with certain exemplary implementations of the present
12 invention, a unique identifier 145 is generated by computing a 64-bit CRC of a
13 concatenated or otherwise arranged binary representation of the file header and the
14 file contents of various files in the DVD's VIDEO_TS directory. This is capability
15 is further illustrated in Figs 13 and 14.

16 A UniqueID2 algorithm generates the identifier in four steps:

17 Step 1. The filenames of the VIDEO_TS directory are collected and sorted
18 alphabetically.

19 Step 2. The file headers from each file are computed in the CRC.

20 Step 3. The data from the VMGI file ("VIDEO_TS\VIDEO_TS.IFO") is
21 computed in the CRC.

22 Step 4. The data from the first VTSI file ("VIDEO_TS\ VTS_xx_O.IFO")
23 is computed in the CRC.
24
25

The 64-bit CRC is computed using an irreducible polynomial in the field $GF(2)$. An example polynomial is:

$$P_{64} = x^{64} + x^{61} + x^{58} + x^{56} + x^{55} + x^{51} + x^{50} + x^{47} + x^{42} + x^{39} + x^{38} + x^{35} + x^{33} + x^{32} + x^{31} + x^{29} + x^{26} + x^{25} + x^{22} + x^{17} + x^{14} + x^{13} + x^9 + x^8 + x^6 + x^3 + x^0$$

The polynomial is generated by finding an exponent n such that $x^n - 1$ has an irreducible (prime) factor of degree 64.

The actual CRC value is computed, in certain examples, by concatenating all of the binary data into a single block (bits b_0 to b_n), assigning each bit b_i to the coefficient x^i in a polynomial, then computing the remainder after dividing by the polynomial P_{64} :

$$CRC_{64} = \left[\sum_{i=0}^n b_i x^i \right] \bmod p_{64}$$

Here's an exemplary implementation:

Step 1

The filenames of the VIDEO_TS directory are collected and sorted alphabetically in to a list.

Step 2

For each filename in the list, the following structure is filled out and added to the CRC (all data fields are in LSB first):

Unsigned 64 bit integer: dateTime (the time elapsed in 100 nanosecond intervals from January 1, 1601)

unsigned 32 bit integer: dwFileSize

BYTE bFilename[filename Length]

BYTE bFilenameTermNull=0

1 Step 3

2 If present, the first 65536 bytes of the file "VIDEO_TS\VIDEO_TS.IFO"
3 are read and added to the CRC. If the IFO file is less than 65536, then the entire
4 file is added.

5 Step 4

6 If present, the first 65536 bytes of the file "VIDEO_TS\ VTS_01_O.IFO"
7 are read and added to the CRC. If the IFO file is less than 65536, then the entire
8 file is added.

9 Although some preferred implementations of the various methods and
10 arrangements of the present invention have been illustrated in the accompanying
11 Drawings and described in the foregoing Detailed Description, it will be
12 understood that the invention is not limited to the exemplary implementations
13 disclosed, but is capable of numerous rearrangements, modifications and
14 substitutions without departing from the spirit of the invention as set forth and
15 defined by the following claims. Additionally, each of the references identified
16 above is expressly incorporated in their entirety herein, by reference, and for all
17 purposes.

1 CLAIMS

2 What is claimed is:

3 1. In a system comprising a multimedia player application operatively
4 configured to interface with a multimedia navigator program via at least one
5 application programming interface (API), a method comprising:

6 causing the multimedia player application to identify to the API the
7 availability of a parental level change feature; and

8 upon finding a need for a parental level change, causing the multimedia
9 navigator program to pause and blocking playback of corresponding media content
10 until the multimedia player application indicates that it accepts an appropriate
11 requested parental level.

12
13 2. The method as recited in Claim 1, wherein the media content
14 includes digital versatile disc (DVD) formatted content.

15
16 3. The method as recited in Claim 1, wherein the multimedia player
17 application presents a user interface seeking authority to set the appropriate
18 parental level while the media content is paused.

19
20 4. The method as recited in Claim 1, wherein upon the acceptance of
21 the appropriate parental level, the paused media content continues playback
22 without restarting from a previously played portion of the media content.

23
24 5. The medium as recited in Claim 1, wherein the media content
25 includes selectable multiple segments, each being associated with a parental level,

1 and wherein the multimedia navigator program is configured to suggest an
2 appropriate segment upon encountering multiple segments during playback to the
3 multimedia player application.

4
5
6 7. In a system comprising a multimedia player application operatively
7 configured to interface with a multimedia navigator program via at least one
8 application programming interface (API), a computer-readable medium having
9 computer-executable instructions for performing steps comprising:

10 causing the multimedia player application to identify to the API the
11 availability of a parental level change feature; and

12 upon finding a need for a parental level change, causing the multimedia
13 navigator program to pause and blocking playback of corresponding media content
14 until the multimedia player application indicates that it accepts the requested
15 parental level.

16
17 8. The computer-readable medium as recited in Claim 7, wherein the
18 media content includes digital versatile disc (DVD) formatted content.

19
20 9. The computer-readable medium as recited in Claim 7, wherein the
21 multimedia player application presents a user interface seeking authority to set the
22 appropriate parental level while the media content is paused.

23
24 10. The computer-readable medium as recited in Claim 7, wherein upon
25 the acceptance of the appropriate parental level, the paused media content

1 continues playback without restarting from a previously played portion of the
2 media content.

3
4 11. The computer-readable medium as recited in Claim 7, wherein the
5 media content includes selectable multiple segments, each being associated with a
6 parental level, and wherein the multimedia navigator program is configured to
7 suggest an appropriate segment upon encountering the segment during playback to
8 the multimedia player application.

9
10
11
12 13. A system comprising:
13 a multimedia player application;
14 a multimedia navigator program; and
15 at least one application programming interface (API) configured to
16 operatively interface the multimedia player application with the multimedia
17 navigator program, and wherein the multimedia player application is configured to
18 identify to the API the availability of a parental level change feature and upon
19 finding a need for a parental level change the multimedia navigator program
20 pauses and blocks playback of corresponding media content until the multimedia
21 player application indicates that it accepts the requested parental level.

22
23 14. The system as recited in Claim 13, wherein the media content
24 includes digital versatile disc (DVD) formatted content.

1 15. The system as recited in Claim 13, wherein the multimedia player
2 application presents a user interface seeking authority to set the appropriate
3 parental level while the media content is paused.

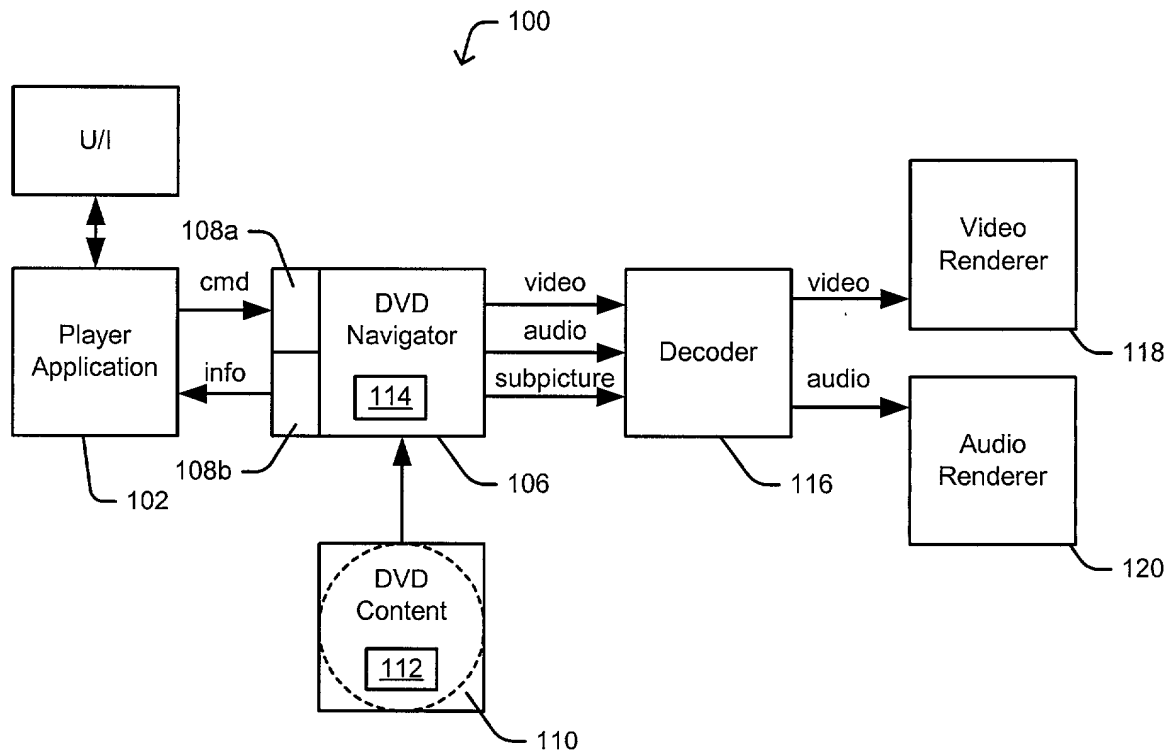
4
5 16. The system as recited in Claim 13, wherein upon the acceptance of
6 the appropriate parental level, the paused media content continues playback
7 without restarting from a previously played portion of the media content.

8
9 17. The system as recited in Claim 13, wherein the media content
10 includes selectable multiple segments, each being associated with a parental level,
11 and wherein the multimedia navigator program is configured to suggest an
12 appropriate segment upon encountering the segment during playback to the
13 multimedia player application.

1 **ABSTRACT**

2 In accordance with certain aspects of the present invention, enhancements
3 have been developed to further extend the performance of the generic DVD
4 navigator with respect to restricted access, such as parental controlled access. The
5 methods and arrangements provided herein support various decision mechanisms
6 associated with conventional dual branching operations and coordinating the
7 handling of parental level requests. The methods and arrangements also support a
8 plurality of parental levels and multi-segment parental level branching schemes.

9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25

*Fig. 1*

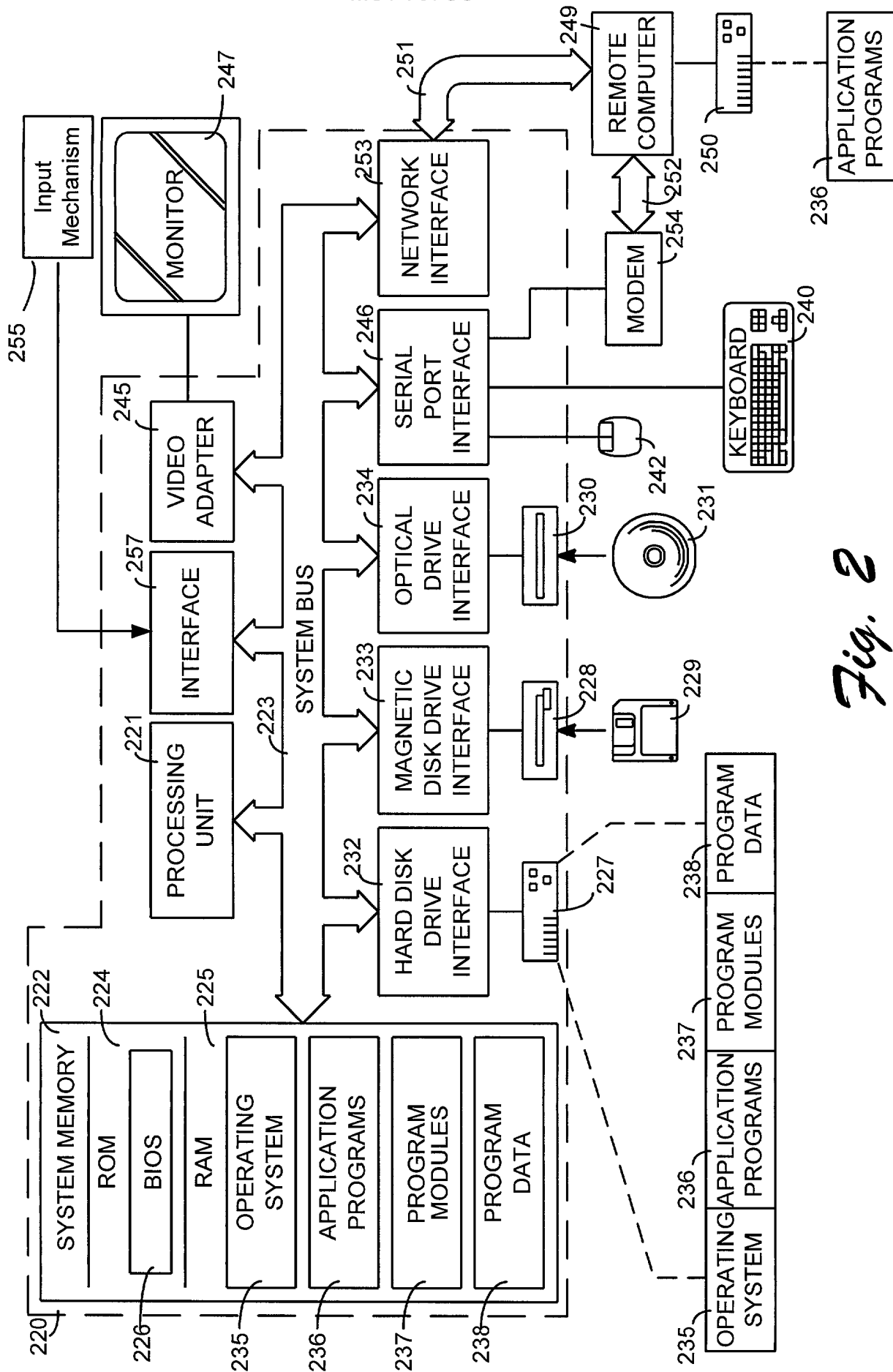


Fig. 2

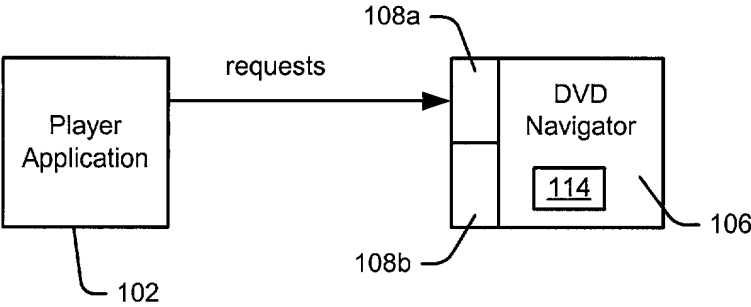


Fig. 3

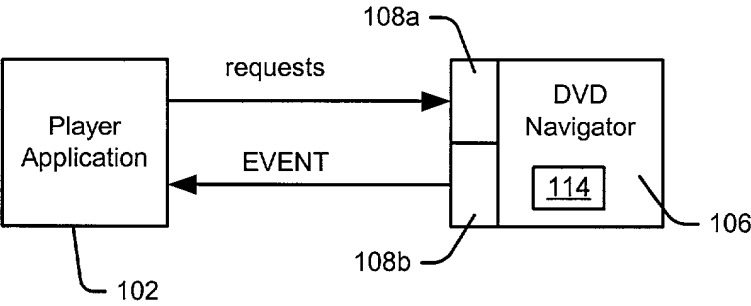


Fig. 4

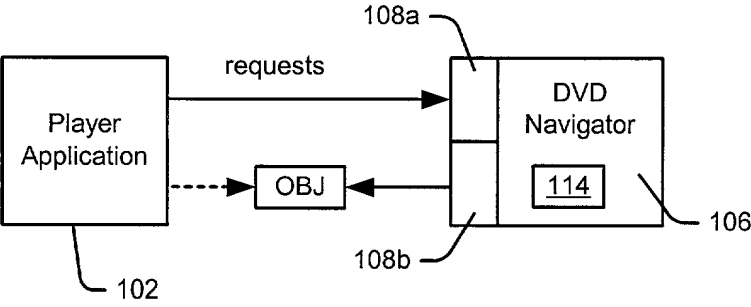
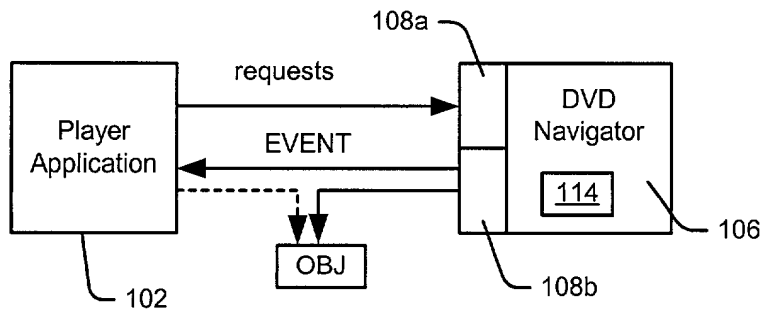
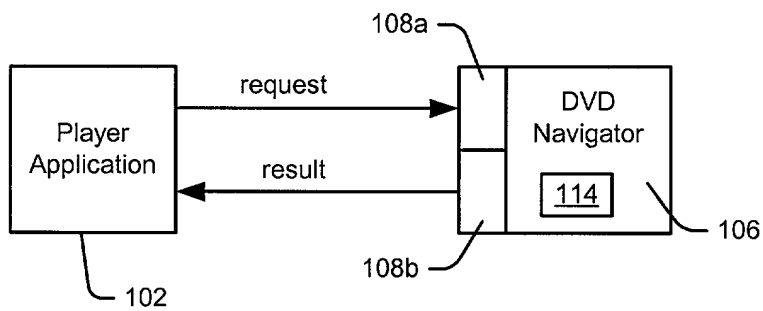
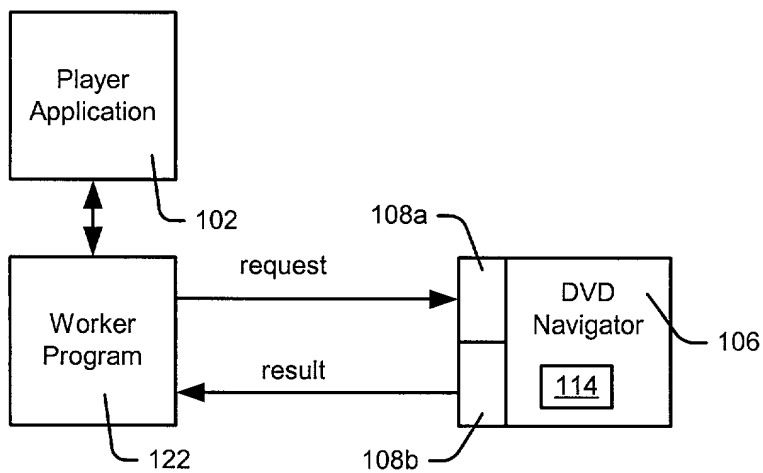
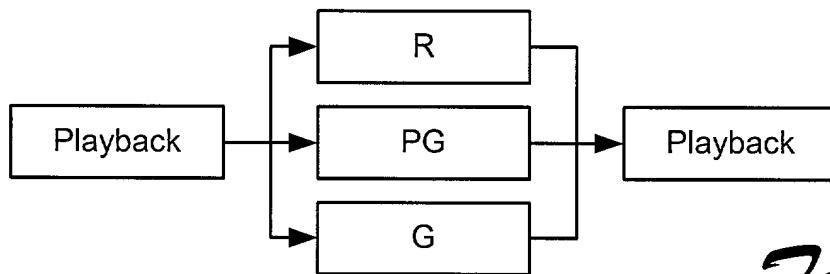
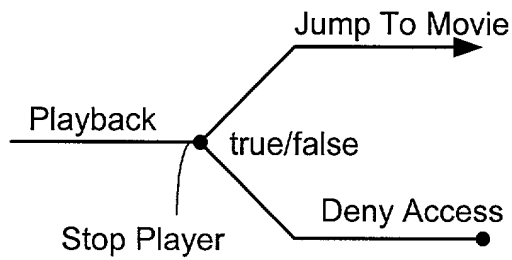
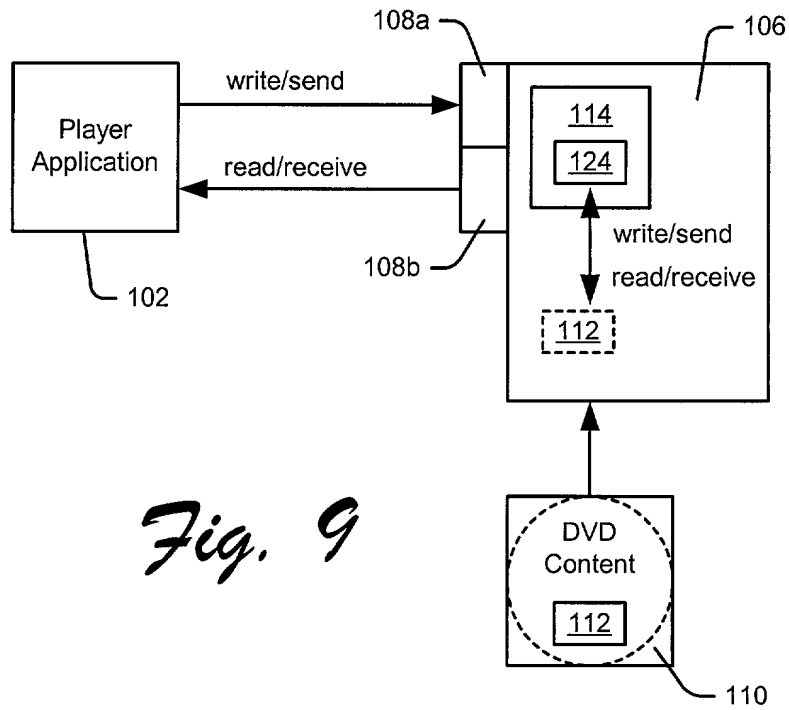
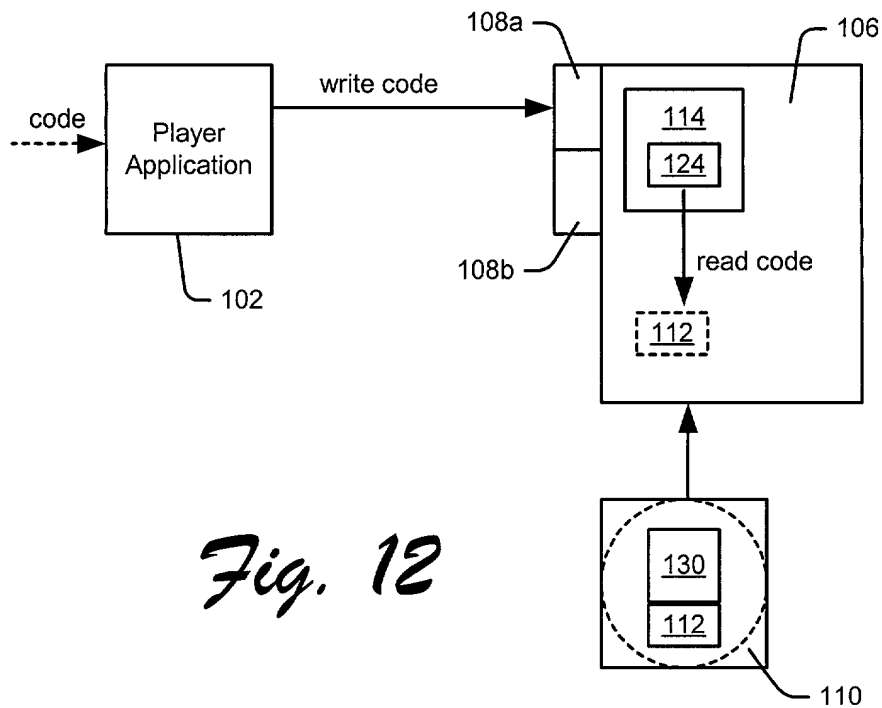
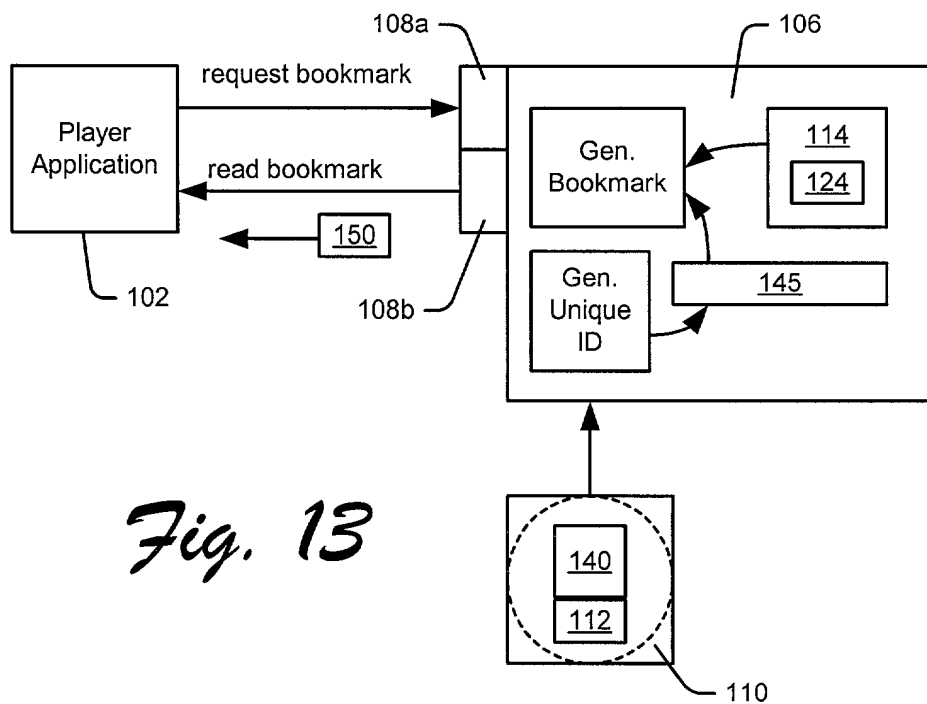


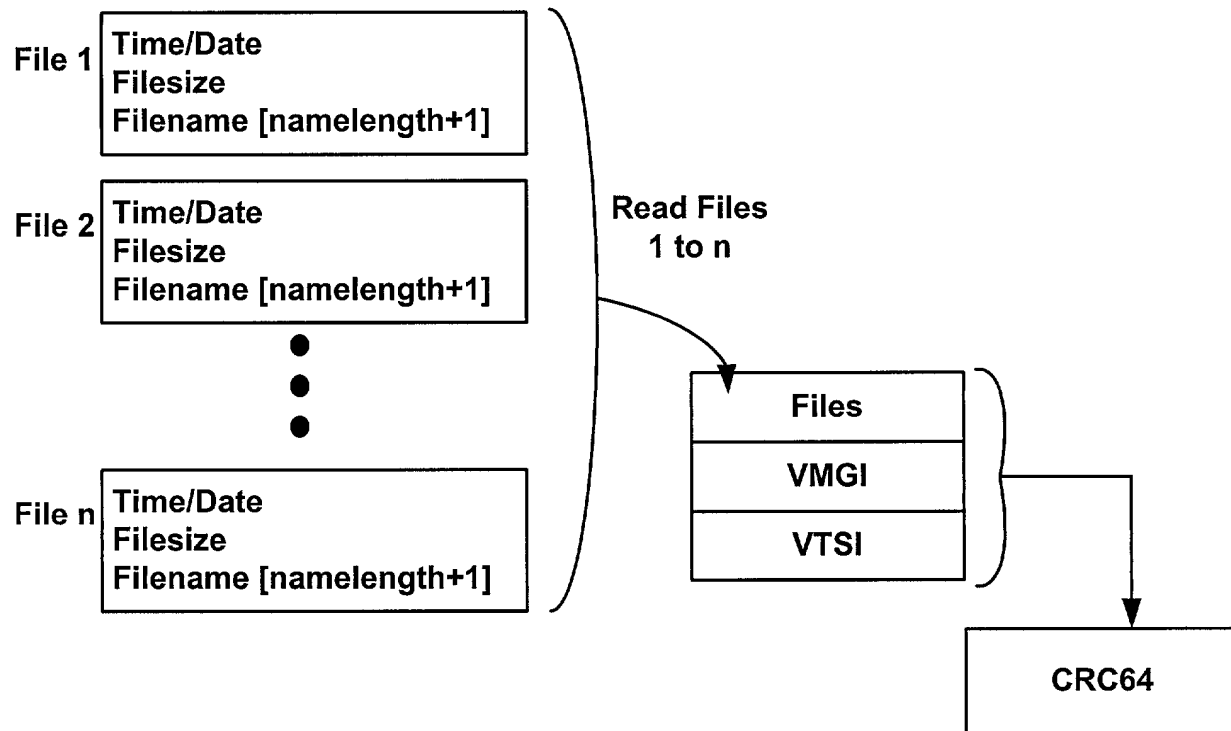
Fig. 5

MS1-707US

*Fig. 6**Fig. 7**Fig. 8*



*Fig. 12**Fig. 13*

*Fig. 14*

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Inventorship..... Evans
 Applicant..... Microsoft Corporation
 Attorney's Docket No. MSI-707US
 Title: Improved Restricted Content Viewing Methods and Arrangements For Use in
 a DVD Player

DECLARATION FOR PATENT APPLICATION

As a below named inventor, I hereby declare that:

My residence, post office address and citizenship are as stated below next to
 my name.

I believe I am the original, first and sole inventor (if only one name is listed
 below) or an original, first and joint inventor (if plural names are listed below) of the
 subject matter which is claimed and for which a patent is sought on the invention
 entitled "Improved Restricted Content Viewing Methods and Arrangements For Use
 in a DVD Player," the specification of which is attached hereto.

I have reviewed and understand the content of the above-identified
 specification, including the claims.

I acknowledge the duty to disclose information which is material to the
 examination of this application in accordance with Title 37, Code of Federal
 Regulations, § 1.56(a).

PRIOR FOREIGN APPLICATIONS: no applications for foreign patents or
 inventor's certificates have been filed prior to the date of execution of this
 declaration.

Power of Attorney

I appoint the following attorneys to prosecute this application and transact all
 future business in the Patent and Trademark Office connected with this application:
 Lewis C. Lee, Reg. No. 34,656; Daniel L. Hayes, Reg. No. 34,618; Allan T.

1 Sponseller, Reg. 38,318; Steven R. Sponseller, Reg. No. 39,384; James R.
2 Banowsky, Reg. No. 37,773; Lance R. Sadler, Reg. No. 38,605; Michael A. Proksch,
3 Reg. No. 43,021; Thomas A. Jolly, Reg. No. 39,241; David A. Morasch, Reg. No.
4 42,905; Kasey C. Christie, Reg. No. 40,559; Nathan R. Rieth, Reg. No. 44,302;
5 Brian G. Hart, Reg. No. 44,421; Katie E. Sako, Reg. No. 32,628 and Daniel D.
6 Crouse, Reg. No. 32,022.

7 Send correspondence to: LEE & HAYES, PLLC, 421 W. Riverside Avenue,
8 Suite 500, Spokane, Washington, 99201. Direct telephone calls to: Thomas A. Jolly
9 (509) 324-9256.

10
11 All statements made herein of my own knowledge are true and that all
12 statements made on information and belief are believed to be true; and further that
13 these statements were made with the knowledge that willful false statements and the
14 like so made are punishable by fine or imprisonment, or both, under Section 1001 of
15 Title 18 of the United States Code and that such willful false statement may
16 jeopardize the validity of the application or any patent issued therefrom.

17
18 * * * * *

19 Full name of inventor: Glenn F. Evans

20 Inventor's Signature

Glenn Evans

Date: Nov 22, 2000

21 Residence:

Kirkland, WA

22 Citizenship:

Canada

23 Post Office Address:

7833 NE 133rd Pl.
Kirkland, WA 98034